A SUSTAINABILITY ACTION PLANNING TOOL

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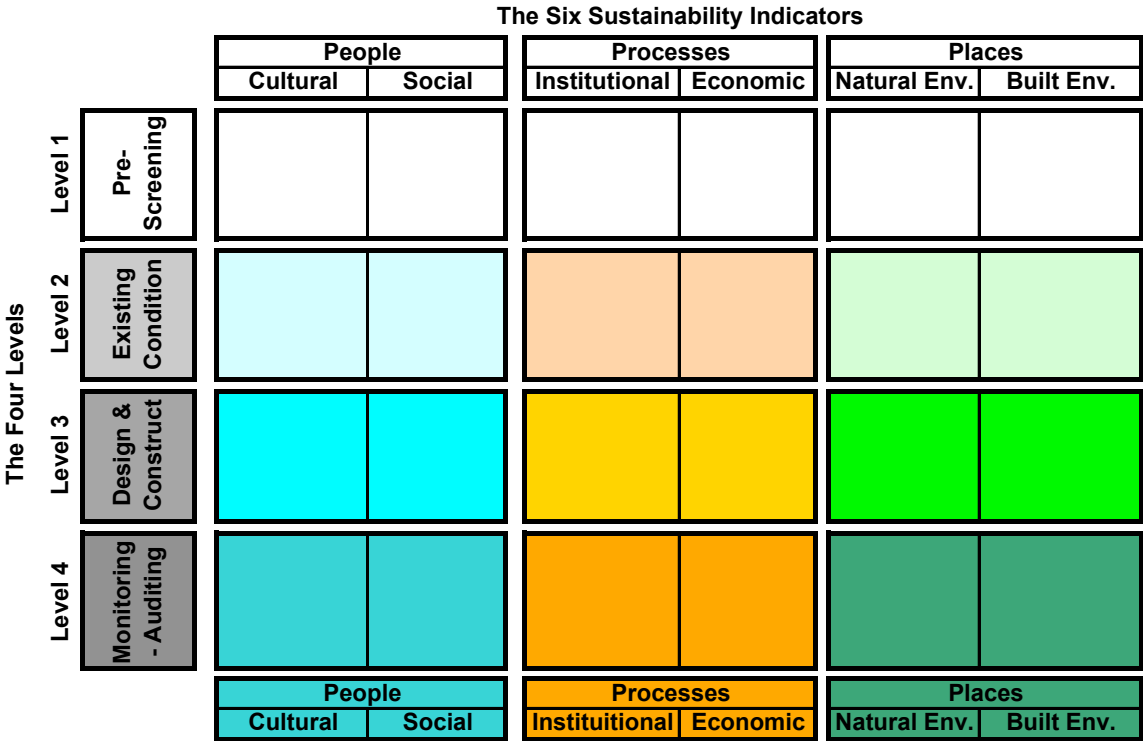
(Philosophy, policy and practice or Tools for managing sustainability)

ABSTRACT

A 'Sustainability Action Planning Tool' is presented to evaluate options for providing urban 3-waters infrastructure systems which will satisfy a policy of sustainability. The basis of the tool is an Excell-based spreadsheet using multi-criteria analysis methodology. The unique features of the tool are:

- Re-definition of the six elements of sustainability (cultural, social, institutional, economic, natural and built environments) into three groups of People, Processes and Places. Each group comprises two of the elements, namely, People (cultural & social), Processes (institutional and economic) and Places (natural and built environments).
- The ability to use the tool at all stages of a project, from the initial conceptual stages, analysis of existing conditions, design & construction, and the final monitoring & auditing stages.
- The inclusion of site specific 'themes' (for example, water quantity, water quality, green network, strong communities etc.) that can be evaluated in terms of the overall six elements of sustainability.
- The ability to incorporate the influence of different sustainability indicators across all six elements of sustainability and at different stages of a project.
- A clear one-page graphical summary.

The overall sustainability framework is presented graphically in the form of a diagram of interlinking rows and columns as presented below:



1. INTRODUCTION

The unique features of the 'Sustainability Action Planning Tool' are summarised under the following headings:

- The six basic sustainability criteria
- The People, Processes and Places framework
- Design integration – estimating the influence of different indicators
- The choice of Sustainability Indicators
- A one-page summary showing different indicators

2. THE SIX BASIC SUSTAINABILITY CRITERIA

While the initial three sustainability criteria, social – economic – environmental, have provided a good basis for sustainability, recent refinements have identified three other important criteria, making up a total of six criteria:

1. Cultural – cultural traditions and relationships with people and the environment.
2. Social – social relationships and structures, private ownership issues
3. Institutional – public governance and ownership issues
4. Economic – the life cycle economic/financial issues
5. Natural Environment – use of resources and management of the air, land and water quality
6. Built Environment – manufactured capital in the form of physical assets of pipes, buildings and transportation networks

The reasons for including the additional three criteria of cultural, institutional and built environment are summarised below.

Cultural: This is of special interest for the New Zealand context where specific regulation mandates the consideration of cultural issues when assessing different sustainability options (for instance, the native Maori, or Iwi, have specific cultural preferences for the disposal of wastewater on to land rather than directly to the sea or water body, irrespective of the degree of technical water quality treatment).

Institutional: Forward progress in implementing alternative, more sustainable options are often dependent not only on technical issues, but on legal and regulatory considerations (for example, the installation of rain water tanks on individual properties as part of the public stormwater infrastructure requires consideration of the legal requirements and ownership/maintenance details of private infrastructure serving as a part of public infrastructure).

Built Environment: Our surrounding environment comprises both natural environments (encompassing air, land and water) and the built environment (including man-made infrastructure such as pipes, buildings, roads etc.). These two types of environment are often measured by different types of indicators (for example,

indicators for the natural environment include the measurement of biodiversity and pollutant concentrations, where as indicators for the built environment may measure embodied energy of different materials such as concrete, steel, timber or HDPE).

3. THE PEOPLE, PROCESSES AND PLACES FRAMEWORK

An underlying framework or structure representing the relationships between the different sustainability criteria is very important in understanding and communicating the many facets of sustainability.

The need for a framework to manage the urbanisation process (in this case, sustainable development) is not new. For instance, Le Play in the 1800's and Geddes in the 1900's had trilogy frameworks that are very similar to the social, economic and environmental sustainability trilogy of today (Bell and Tyrwhitt 1972). In 2000, the Dutch have used the trilogy of People, Profit and Planet (see table below):

Le Play (1800's)	**Geddes (1915)**	**Dutch Social-Economic Planning Council (Goldberg 2001)**	**Traditional Sustainability Trilogy**
Family	Folk	People	Social
Work Patterns	Work	Profit	Economic
Environment	Place	Planet	Environmental

The common theme presented by these examples is the trilogy of:

- People – social aspects including the family, folk and people characteristics
- Work – work/business aspects producing profit and economic outcomes
- Environment – environmental aspects of our planet and places we live.

To maintain this same basic trilogy, the author proposes the following categories of people, processes and places.

Traditional Sustainability Trilogy	**Authors Preferred Groupings**	**Six Sustainability Criteria**	**Explanation**
Social	People	Cultural	***People*** combines both the cultural and social aspects
		Social	
Economic	Processes	Institutional	Includes both the institutional and economic aspects, which are the vital ***processes*** by which the ***people*** interact and link with the ***places*****,** or environment.
		Economic	
Environmental	Places	Natural Environment	***Places*** includes both the natural (ecological) and built (buildings and infrastructure) environment.
		Built Environment	

4. DESIGN INTEGRATION

Analysis of working examples of more sustainable options are indicating that the best solutions are based not on tradeoffs or balancing, but on design integration achieving all of them together (Hawken et al, 1999). Paul Hawken et al in their book *Natural Capitalism,* state their findings thus:

> *"But as we sifted and distilled those new business cases, we realised that the conventional wisdom is mistaken in seeing priorities in economic, environmental, and social policy competing. The best solutions are based not on tradeoffs or balance between these objectives but on design integration achieving all of them together – at every level, from technical devices to production systems to companies to economic sectors to entire cities and societies."*

To portray the aspect of design integration of all six sustainability criteria the proposed basic spreadsheet model allows for the weighting of each of the indicators in all or some of the six sustainability criteria (see sample below).

The total weighting for each of the individual indicators (e.g. Risk/Magnitude of Damage to Private Property) is summed across the rows, while the overall weighting of each of the six sustainability criteria (e.g. Social) is summed down the columns.

Planning, Design and Construction	EXAMPLE ONLY	PEOPLE		PROCESSES		PLACES			
		Cultural	Social	Inst.	Eco.	Nat.Env.	Blt Env.		
		0	40	15	35	35	40		
Water quantity	Risk/Magnitude of Damage to Private Property		5				5	10	
	Risk/Magnitude of Damage to Drainage Infrastructure (Public)			5			5	10	
	Minimsing hazards during flooding (Safety Risk from Flooding)		5				5	10	
	Mains water used - indicator of total demand on water supply system				5		5	10	
	Water Cycle Balance					10		10	5
Water Quality	Suspended and pollutant load concentrations					10		10	
	Total Combined Sewer Overflow Volume per length pipe in typical year					10		10	2
Amenity/Public Impact	Public Access (change in length accessible)		10					10	
	Public Use (Potential for greater multipurpose use)		5					5	
	Public Area Aesthetics (visual contaminants and odour)		5					5	2
Economic/Financial and Ownership/Management Policy Decision views	Life Cycle Costs (LCC) for **public sector** - CAPEX, OPEX and Maint.			5	10			15	
	Life Cycle Costs (LCC) for **private sector** - CAPEX, OPEX and Maint.		5		10			15	
	Ownership/Management issues - **public sector**			5			5	10	
	Ownership/Management issues - **private sector**		5				5	10	5
Energy Use	Ongoing energy use				10		5	15	
	Embodied energy use					5	5	10	3

In the above example the 'Water Quality' grouping comprises five indicators. Each indicator has been given an overall weighting of 10, which has been split up between the different criteria of social, institutional, economic, natural and built environments. The 'Water Quality' and 'Amenity/Public Impact' indicators only affect the 'Natural Environment' and 'Social' criteria respectively. Whereas, the life cycle cost (LCC) indicators are represented as not only affecting more than one criteria (social, institutional and economic), but have been given different individual weightings. For instance, the LCC for the public sector has an overall weighting of 15, with the majority (a weighting of 10) given to the economic criteria, and less weighting to the institutional criteria. This reflects that the life cycle costs are predominantly economic criteria, but have some influence on the institutional and social criteria, as these are the affected responsible parties.

This spreadsheet based model of the individual and summed weightings allows for a graphical presentation of the interconnected, integration of different indicators across different site-specific headings and the different six overall sustainability criteria. This is especially useful when dealing with different authorities, as they all tend to arrange their indicators under different headings. See examples below from different New Zealand local authority strategic documents.

Hamilton's Strategic Plan 2002 – 2012 (Hamilton City Council 2001)	**Waitakere's Nine Strategic Platforms (URS Maunsell & Synergine 2004)**	**Rotorua District Council's State of the Environment Report 2002 (Rotorua District Council 2002)**
1. Sustaining the Environment	1. Strong Innovative Economy	1. Tangata whenua
2. Growing	2. Integrated Transport and Communication	2. Water
3. Promoting	3. Three Waters	3. Land
4. Experiencing Arts, Culture and Heritage	4. Sustainable Energy and Clean Air	4. Transport
5. Living	5. Green Network	5. Urban
6. Enjoying	6. Strong Communities	
	7. Active Democracy	
	8. Zero Waste	
	9. Urban and Rural Villages	

5. THE CHOICE OF SUSTAINABILITY INDICATORS

Choosing the right sustainability indicators with agreement and buy-in from all the relevant stakeholders is perhaps the most important step in the sustainability decision-making process. Choosing the right indicators is not necessarily a simple process because:

1. While most engineers and planners have been involved with simple indicator matrices for items such as the choice of treatment plant or water quality device, the matrices have rarely taken into account the full range of cultural, social, economic and environmental impacts that are required for a true sustainability assessment.
2. The most appropriate indicators at the different stages of a project (from conceptual, design, construction and monitoring stages) may not be the same.
3. The need for increased public participation necessitates the need for a simple format and presentation of all the complex interrelationships within the sustainability paradigm.

Indicators also serve several different purposes, such as:

- Educating and explaining sustainability
- Assessing different options
    - Within the same site
    - Between different sites (prioritising works)
- Measuring progress – auditing

The power of choosing the right or wrong indicators should never be underestimated. Herman Daly described an example of a professional indicator program that went wrong in his book, *Beyond Growth (Daly 1996)*. Daly describes an example given to him by a physician in the case of management by quantified objectives applied to a tuberculosis hospital (*Beyond Growth*, page 41):

> *"It is well known that TB patients cough less as they get better. So the number of coughs per day was taken as a quantitative measure of the patient's improvement. Small microphones were attached to the patient's beds, and their coughs were duly recorded and tabulated. The staff quickly perceived that they were being evaluated in inverse proportion to the number of times their patients coughed. Coughing steadily declined as doses of codeine were more frequently prescribed. Relaxed patients cough less. Unfortunately the patients got worse, precisely because they were not coughing up and spitting out the congestion. The cough index was abandoned."*
>
> *"The cough index totally subverted the activity it was designed to measure because people served the <u>abstract quantitative index</u> instead of the <u>concrete qualitative goal of health</u>"*

The underlinings in the above quoted paragraph have been inserted to highlight the apparent paradox where by the quantitative index is referred to as *abstract* and the qualitative goal of health as *concrete*. We normally relate quantitative to concrete and qualitative as abstract. That is, in the search for indicators we often focus on "quantitative" measures because we feel they will be more "accurate", but is this really so?

Maureen Hart sums up the problem of choosing incorrect indicators in her *Sustainable Community Indicators Trainer's Workshop Manual (Hart 1998)*, as follows:

> *"We all set goals and use indicators to measure our progress towards these goals. The problem with measurement is that sometimes we forget what the goal is and just worry about the indicators. The measurement becomes more meaningful than the goal and we start to define ourselves in terms of what we measure, not what we want to be."*

The conclusion is, ***choose your indicators with caution.***

Examples of possible sustainability indicators are presented in section 6 below.

6. A ONE-PAGE SUMMARY

Sustainability, by its very nature, is complex with many interconnected facets. This can very easily lead to circular debates between different stakeholders and interest groups with no clear path for moving forward. The key to getting consensus between all relevant parties is a clear representation of all the key elements and their relationships with each other.

While the spreadsheet format presented above in section 4 is good for calculating the design integration aspects and relevant weightings for the different indicators and criteria, a more summarised format is necessary for communicating the array of indicators used. The proposed one-page summary lists the different indicators under the six rows of sustainability criteria and the 4 levels (stages) of a project (see example on following page).

The proposed summary format serves two important purposes:

1. It allows for easy checking that all six sustainability criteria are adequately covered throughout all phases of a project, and
2. Clearly shows all indicators and their relationships across all six basic sustainability criteria and at different stages of a project in an easy format that can be communicated and understood by all affected parties.

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	Six Sustainability Criteria					
	PEOPLE		PROCESSES		PLACES	
	Cultural	Social	Instit.	Economic	Natural E.	Built E.
Level 1: Pre-screening	Any insurmountable significant cultural and/or social issues (e.g. heritage/equity)		Allowed Activity (by regulators)	Within budget constraints	Impacts on energy and global warming	Physically practical & feasible
Level 2: Existing Conditions	Cultural Health Index	Degree of water problem	% private land ownership	Net maint. costs	Water cycle balance	Uncontrolled overflows
	No. of uses/yr	Interest in alt. technologies			Biodiversity	Controlled overflows
					Pollutant loads	
Level 3: Planning, Design & Construct		Risk to private property	Risk to public property	Risk to public & private prop.		Risk to public & private prop.
	Impact on values & Cultural Health Index	Public acceptability	Ease & time to get consents	Mains water used	Pollutant loads	Proven, reliable tech.
		Ownership issues (private)	Ownership issues (public)		Water cycle balance	Ownership (pvt. & public)
		Degree of pride in option	% private land ownership	Annual energy use	Greenhouse gases (LCA)	Embodied & annual energy
		LCC – private (life cycle costs)	LCC – public (life cycle costs)	LCC – pvt. & public		Controlled overflows
Level 4: Monitoring - Auditing	Cultural Health Index	Degree of water problem	No. of legal infractions	Net maint. costs	Pollutant loads	Maintenance (man hrs/yr)
	No. of uses/yr	Satisfaction with solution	Self regulation		Biodiversity	Controlled overflows

The above table presents examples of different types of indicators that are applicable at different levels and their influence across the six sustainability criteria. Examples of the influence of different types of indicators are described below.

Level 1, 2, 3 and 4 Indicators:

- Level 1 indicators are used at the initial conceptual stage to screen out any "fatal flaw" conditions in both the existing conditions (e.g. significant cultural or social issues) and the proposed technological solutions (e.g. practicality and feasibility of proposed technology).
- Level 2 and 4 indicators tend to be similar, as many of these can be directly measured (such as biodiversity), where as Level 3 indicators are often design or estimated impacts (such as calculated pollutant loads). This example also highlights

the need to measure both pollutant loads and biodiversity in the monitoring Level 4 stage as this serves the important feedback loop required to assist the setting of appropriate pollutant loading concentrations in the Level 3 design stage.

Assessing different options and/or different sites: For assessing *different options for the same site*, Level 3 indicators are more relevant, where as Level 2 indicators are more relevant for assessing *different sites for the same option*.

Indicators across different sustainability criteria: The example in Level 3 of risk to private and public property appears as 'Risk to private property' in the social criteria, 'Risk to public property' in the institutional criteria, and 'Risk to private & public property' in both the economic and built environment criteria.

Semi-sustainability indicators: Some indicators are not 'pure' sustainability indicators such as 'Interest in alternative technologies', 'Public acceptability' and 'Proven, reliable technology'. These indicators are not really measures of an options sustainability, but indicators of the likely private/public uptake of the proposed technology or solution. While private/public acceptability and likely uptake are more short-term than long-term criteria, they are nevertheless important in order to start the process of introducing more sustainable options – provided the options do not have any "fatal flaws", that is, they have passed the initial pre-screening Level 1 stage.

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ACKNOWLEDGEMENTS

PhD Supervisors at the Faculty of Architecture, Property, Planning & Fine Arts, University of Auckland, NZ;

- Dr Robert Vale, Principal Supervisor
- Assoc. Prof. Tom Fookes, Associate Supervisor